Utilizing a suite of satellite missions to address poorly constrained hydrological fluxes

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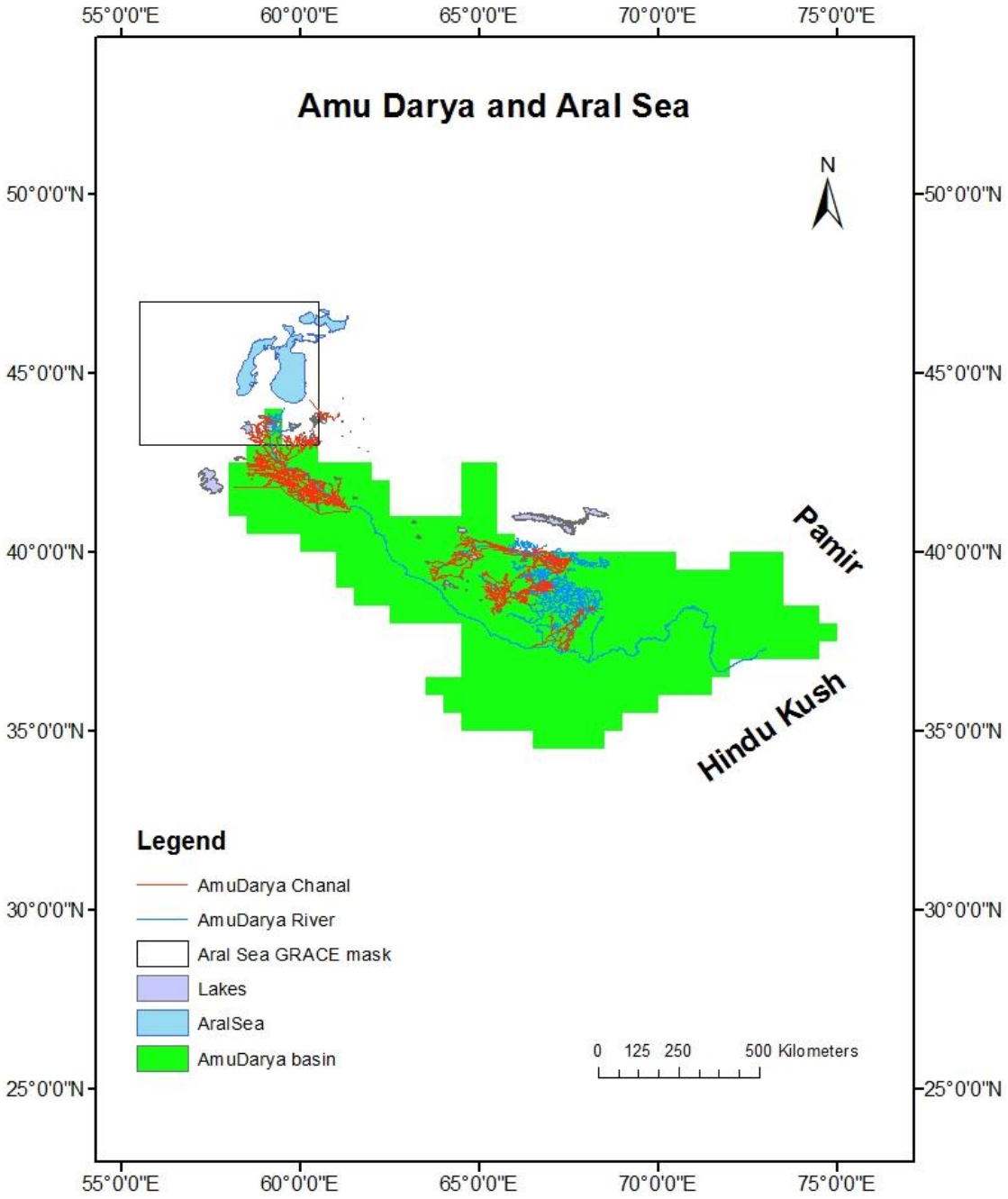
Introduction

- Lakes often significantly contribute to the regional climatology

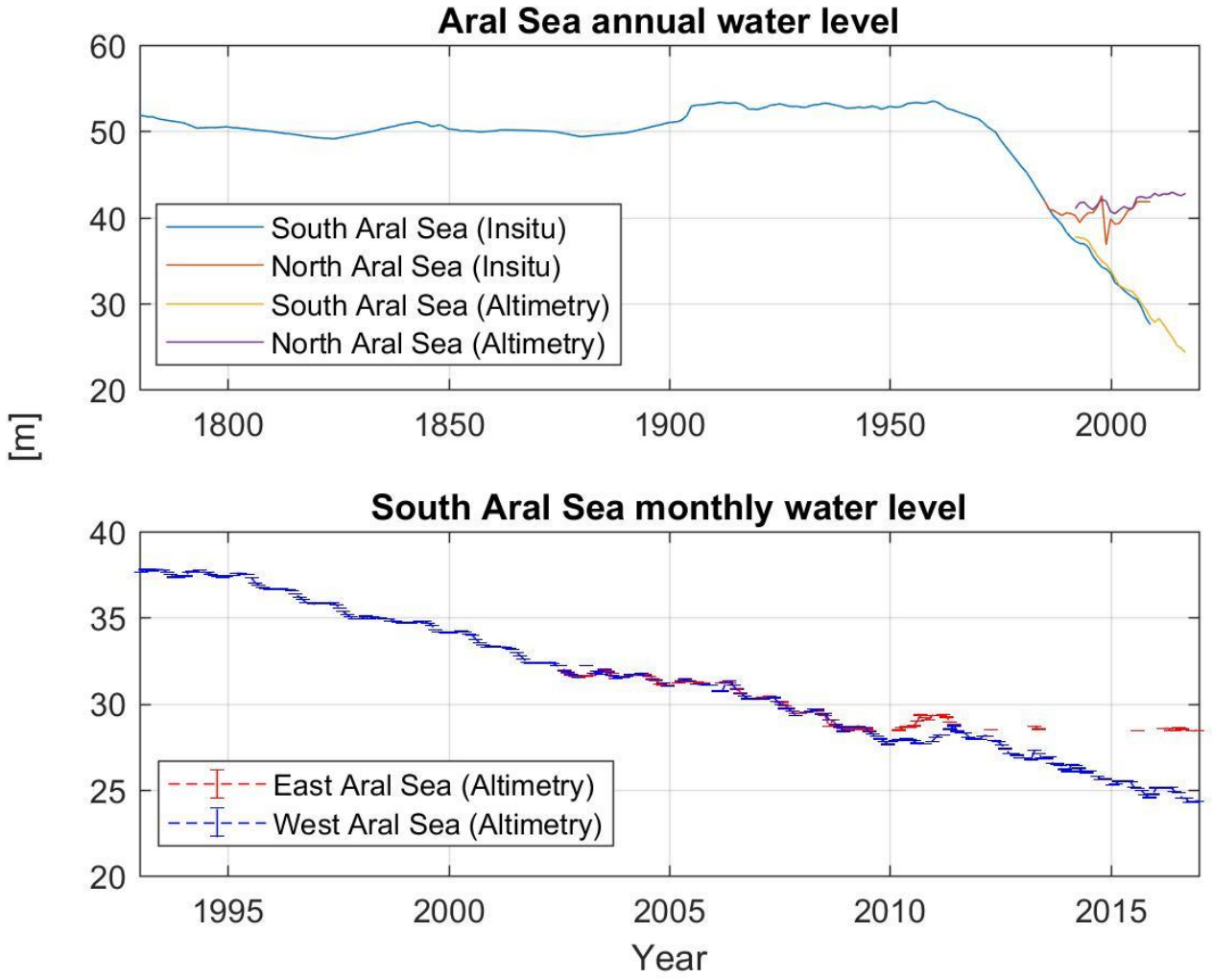
- The present work assesses current remote sensing potentials and determine the challenging areas for further improvement

- The study mainly consists of using remote sensing data to quantify following changes
  - Lake level and volume,
  - The rate of evaporation loss
  - Estimating river streamflow to the lake
  - Assessing the spatiotemporal hydrological variations in the river basin

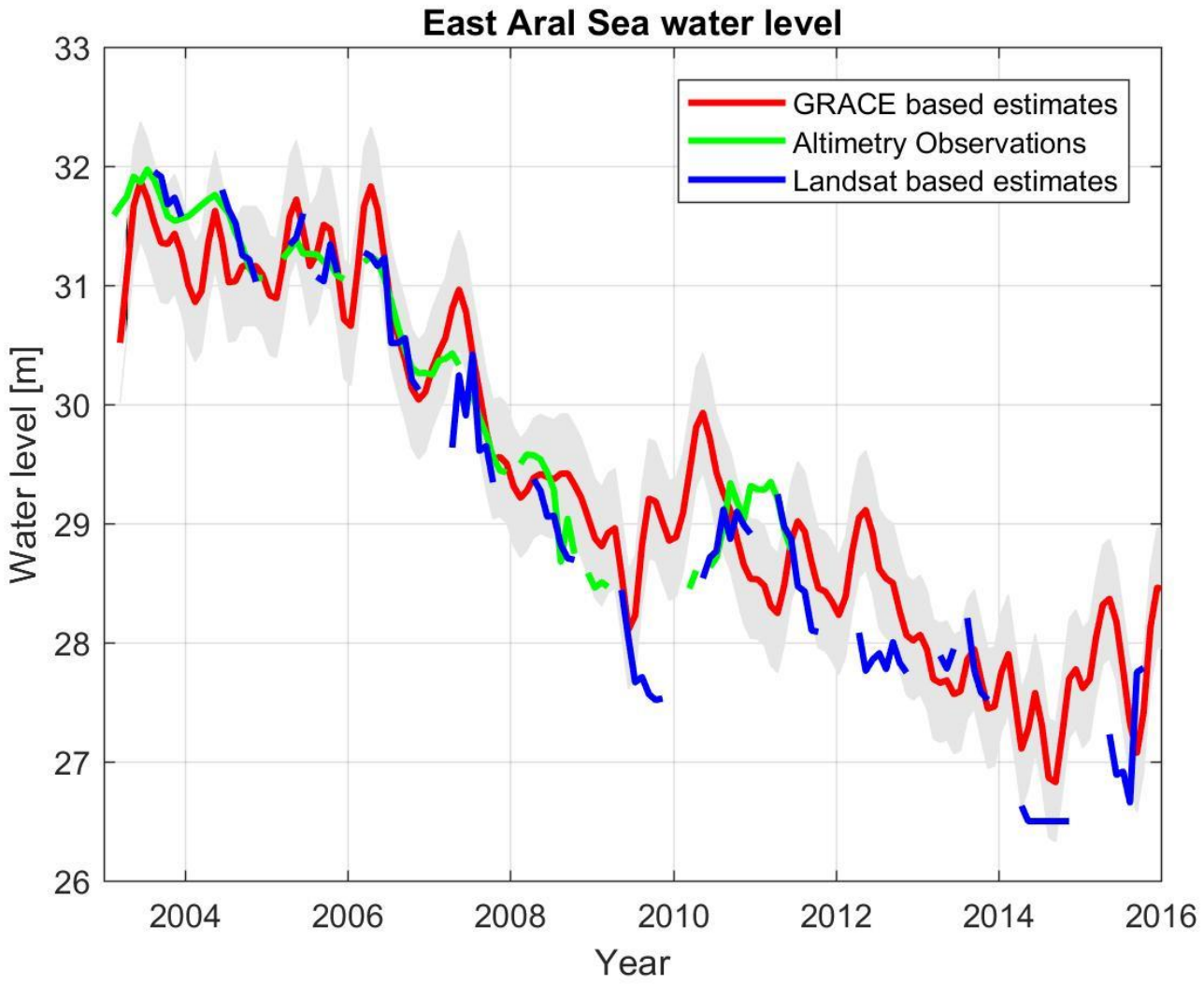
Study area


Amu Darya and Aral Sea
N
55°0'0"E
60°0'0"E
65°0'0"E
70°0'0"E
75°0'0"E
50°0'0"N
45°0'0"N
40°0'0"N
35°0'0"N
30°0'0"N
25°0'0"N
Pamir
Hindu Kush
Legend
AmuDarya Chanal
AmuDarya River
Aral Sea GRACE mask
Lakes
AralSea
AmuDarya basin
0 125 250 500 Kilometers

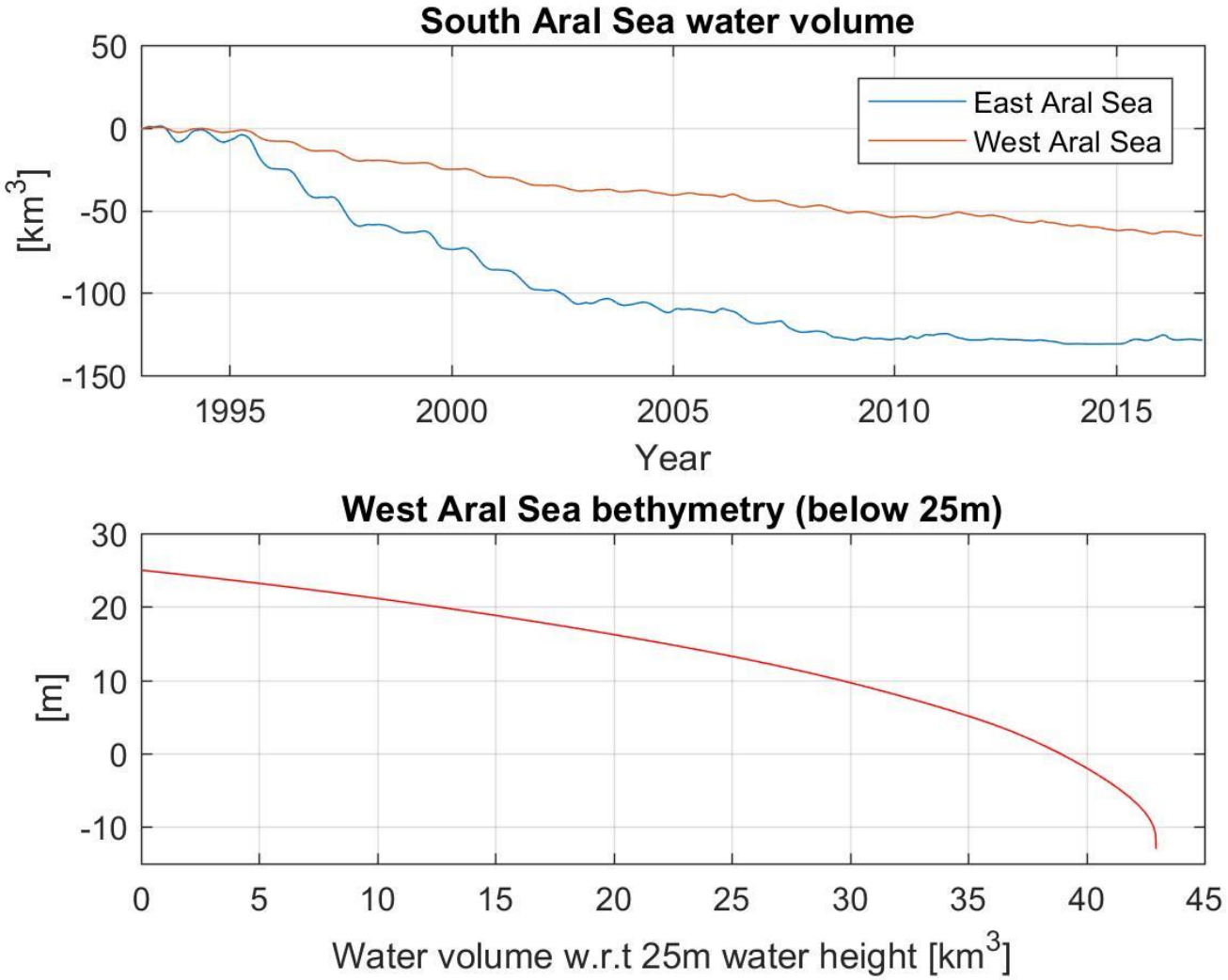
Historical water height



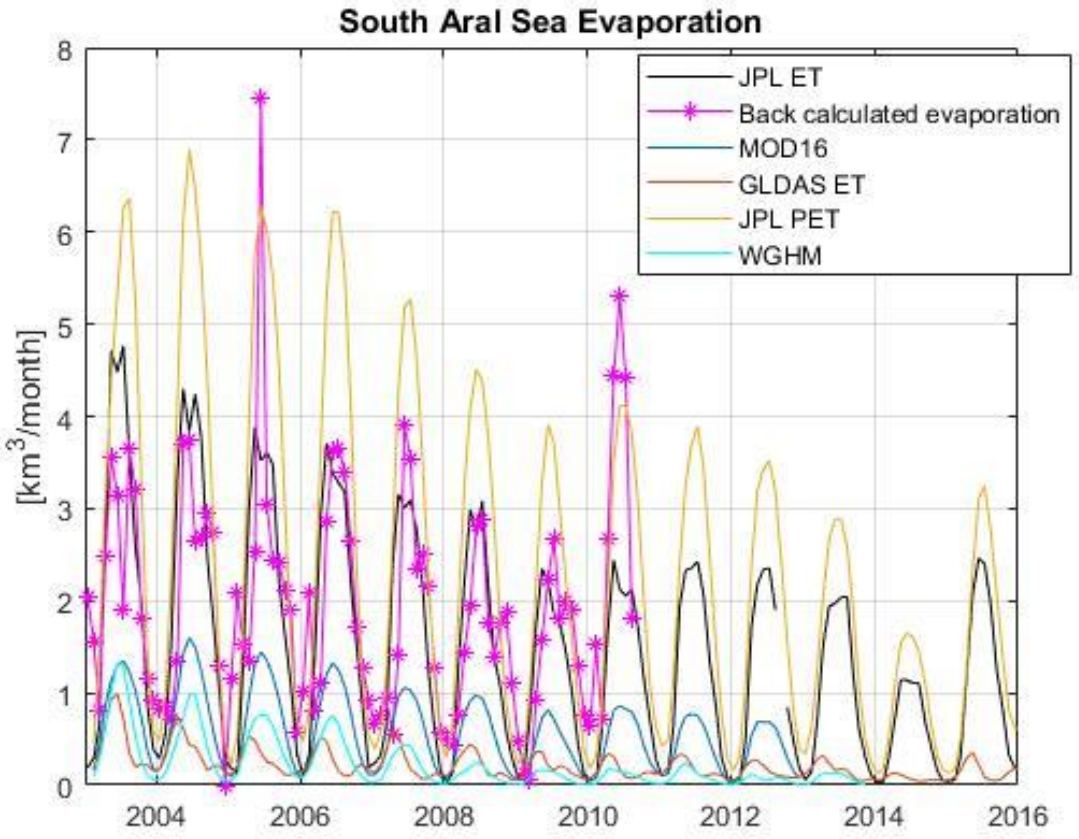
Water levels estimated by altimetry, Landsat and GRACE

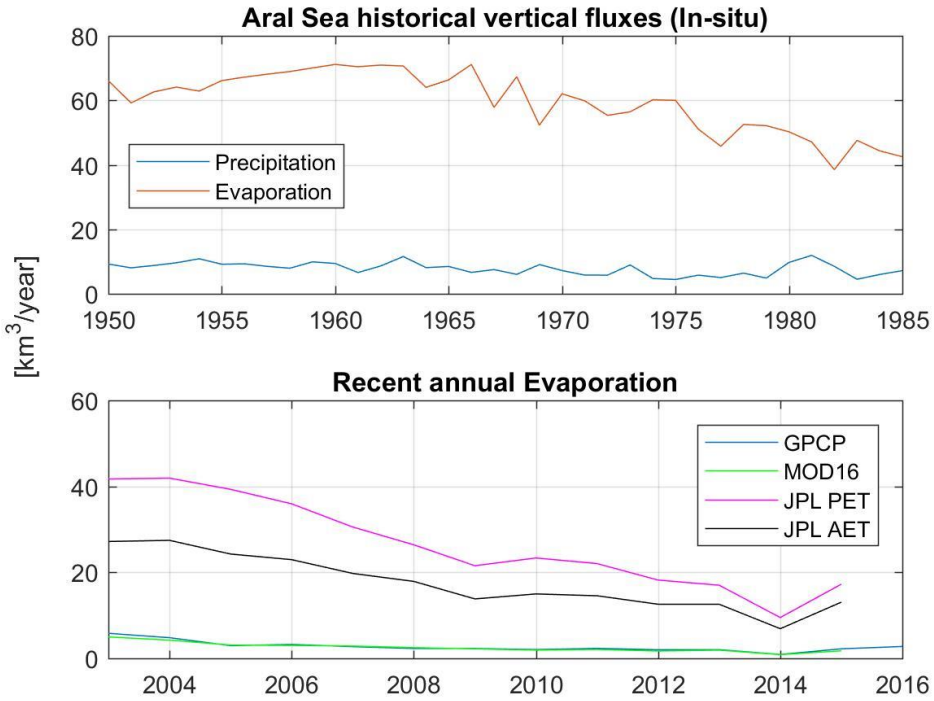


South Aral Sea water volume

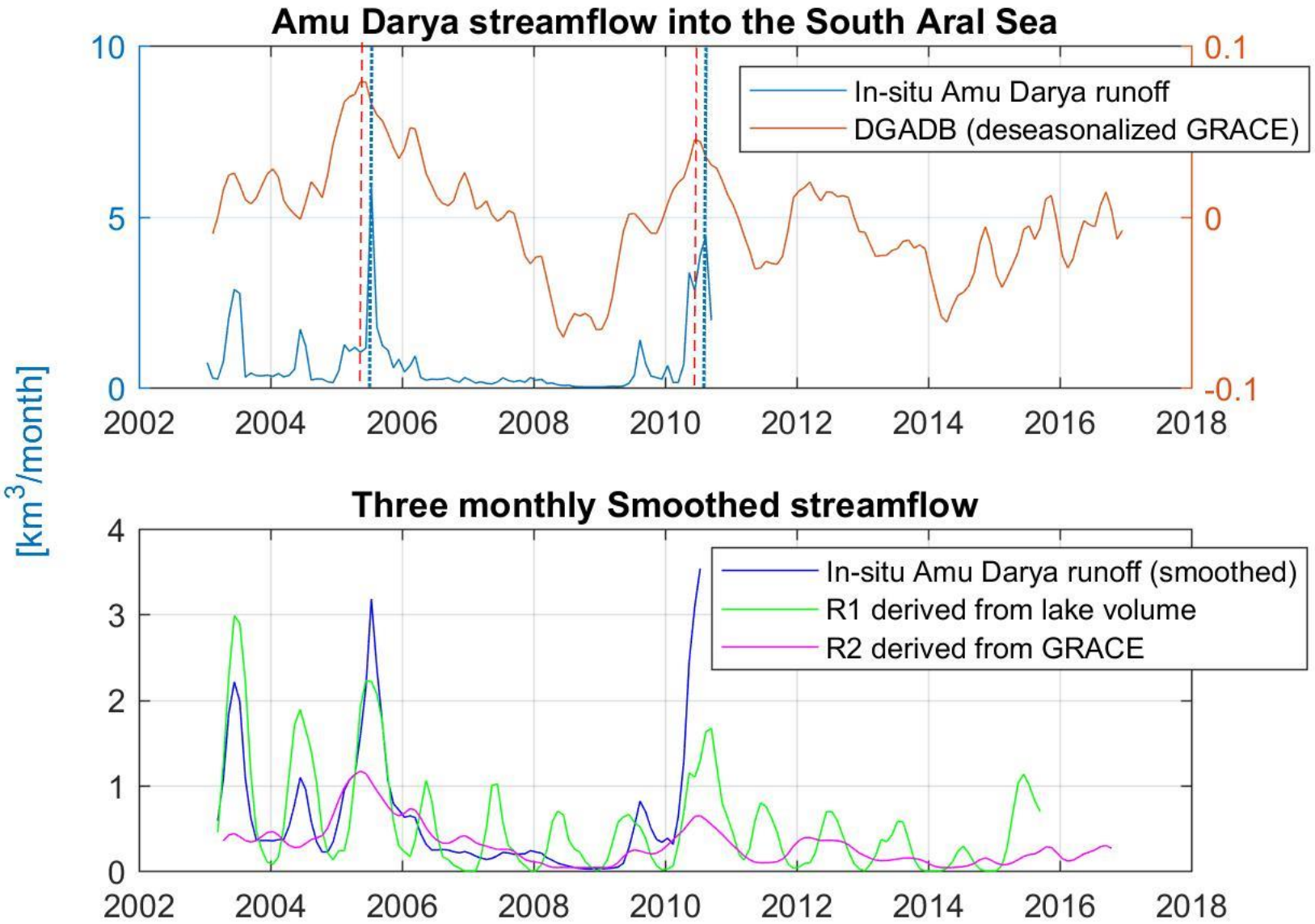


South Aral Sea evaporation

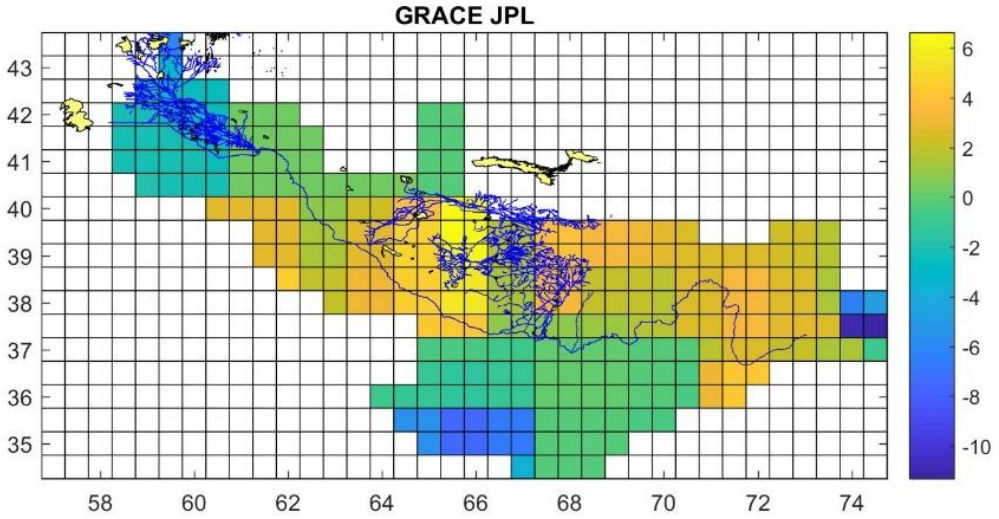


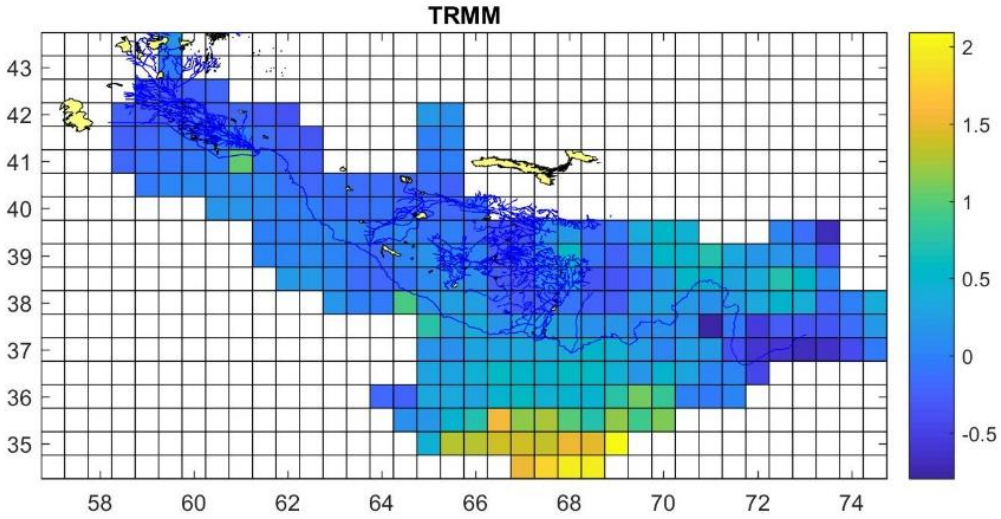


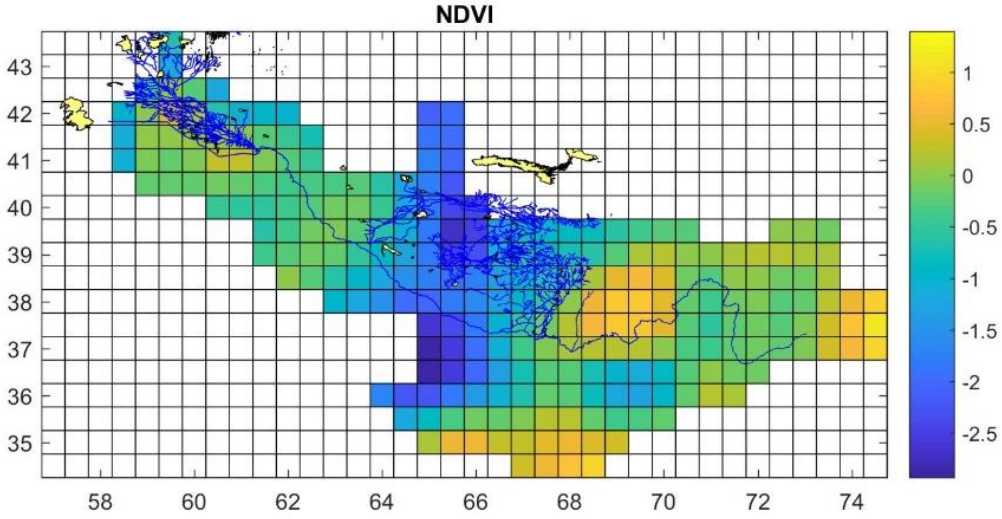
Streamflow into the South Aral Sea

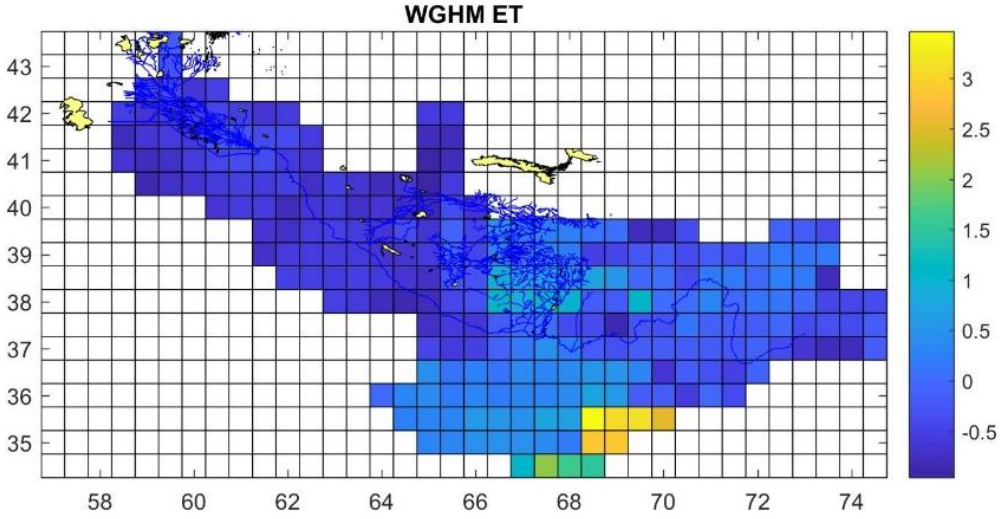


Amu Darya basin









Conclusion

- Landsat images together with bathymetry can provide an alternative water level estimate. GRACE signals from the lakes like the Aral Sea have a potential to fill the water level data gap.
- Integrating altimetry-based lake volume variations with the in-situ runoff and precipitation can back-calculate evaporation from the lake.
- MODIS based JPL-ET found to have the closest approximation with the back-calculated evaporation .
- The GRACE signal from the basin can provide a long-term trend of the streamflow into the lake.
- It may predict the flood events one or two months in advance.
- Increase in total water storage (TWS) in the central Amu Darya basin indicates a rise in infiltration, probably due to worsening of the canal structure in the region.